

8.—BRYOZOA FROM THE WANDAGEE AND NOONCANBAH SERIES (PERMIAN) OF WESTERN AUSTRALIA.

PART ONE.

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CONTENTS.

	Page.
Summary ... ..	165
Introduction ... ..	165
Description of Species:—	
Family Fenestrellinidae Bassler.	
Genus <i>Fenestrellina</i> d'Orbigny.	
<i>Fenestrellina horologia</i> (Bretnall) ... ..	167
<i>Fenestrellina disjecta</i> sp. nov. ... ..	168
<i>Fenestrellina ruidacarinata</i> sp. nov. ... ..	169
<i>Fenestrellina valentis</i> sp. nov. ... ..	169
<i>Fenestrellina columnaris</i> sp. nov. ... ..	170
<i>Fenestrellina lennardi</i> sp. nov. ... ..	171
<i>Fenestrellina cacuminatis</i> sp. nov. ... ..	171
Genus <i>Minitya</i> gen. nov.	
<i>Minitya duplaris</i> sp. nov. ... ..	173
<i>Minitya princeps</i> sp. nov. ... ..	174
Genus <i>Polypora</i> McCoy.	
<i>Polypora fovea</i> sp. nov. ... ..	175
<i>Polypora retificis</i> sp. nov. ... ..	176
<i>Polypora woodsii</i> (Etheridge) ... ..	177
<i>Polypora multiporifera</i> sp. nov. ... ..	177
<i>Polypora</i> sp. nov. indet. ... ..	178
Acknowledgments ... ..	179
Bibliography ... ..	179

SUMMARY.

Fourteen species of Fenestrellinidae (*Fenestrellina* and *Polypora*), of which twelve are described as new, and one new genus allied to *Fenestrellina*, are described from the Wandagee Series of the North-West Basin and the Nooncanbah Series of the Kimberley District (Permian) of Western Australia.

INTRODUCTION.

Bryozoa from the Permian and Carboniferous of Western Australia were first recorded by Huddlestone in 1883, when he described *Evactinopora dendroidea* Huddlestone and *E. crucialis* Huddlestone, and recorded *Fenestellae*, *Fenestella plebia* McCoy, *Protoretipora* (sic) (*Fenestella*) *ampla* Lonsdale var., and *Stenopora tasmaniensis* Lonsdale from the "Carboniferous" North of the Gascoyne River. *Fenestella* ("probably *F. ampla*") was recorded by Foord (1890) from the Irwin River; Hinde, in 1890, recorded *Hexagonella dendroidea* (Huddlestone), and described *Polypora australis* Hinde and *Rhombopora tenuis* Hinde from the "Carboniferous" of the Gascoyne River District.

R. Etheridge jnr. recorded *Stenopora* and *Evactinopora* from Mt. Marmion (1889); *Hexagonella dendroidea* and *H. (?) crucialis* from Fossil Hill, Wyndham River (1903); *Fenestella fossula* Lonsdale from the Irwin River (1907); and *Evactinopora crucialis* and two types of *Stenopora* (*Stenopora* spp. A and C) from Mt. Marmion, and *Stenopora* sp. B from near Barra-biddie (1915). Chapman (1904) recorded *Stenopora leichardtii* Nicholson and Etheridge jnr. from the Irwin River District.

Brettnall (1926) described *Lyropora (?) erkosoides* Etheridge ms., *Fenestella horologia* Brettnall, *F. affluensa* Brettnall, *Sulcorettopora (?) meridianus* Etheridge ms., *Actomocladia ambrosoides* Brettnall, *Streblotrypa marmionensis* Etheridge ms., *S. etheridgei* Brettnall, *Rhombopora mamillata* Brettnall, *R. multigranulata* Brettnall, and *Coscinium (?) australe* Brettnall, and recorded *Rhombopora tenuis* Hinde, from the Permo-Carboniferous of the Gascoyne and Kimberley Districts. Miss L. Hosking (1931) recorded *Actomocladia ambrosoides*, *Coscinium (?)* sp., *Fenestella affluensa*, *F. horologia*, *Rhombopora mamillata*, *R. multigranulata*, *Streblotrypa marmionensis*, and *Sulcorettopora meridianus* from the Wooramel River District.

Etheridge (1907 a) described some Permo-Carboniferous bryozoa from the Port Keats Bore, thirty miles north of Fossil Head, Victoria River estuary, Northern Territory, and discussed their relationships to Western Australian forms.

Gibb Maitland (1909), Raggatt (1936), and Condit, Raggatt, and Rudd (1936), have published lists of fossils, including bryozoa, from the Permo-Carboniferous of the North-West District, and Blatchford (1927) and Wade (1937) from the Permo-Carboniferous of the Kimberley District.

The stratigraphical position of the Wandagee Series has been discussed by Condit (1935), Condit, Raggatt, and Rudd (1936), Raggatt (1936), and Teichert (1939, 1940, 1941); and the position of the Nooncanbah Series by Wade (1937) and Teichert (1940, 1941).

The bryozoa described here are from the Wandagee Series of the North-West Basin, and from the Nooncanbah Series of the Kimberley District. Fourteen species are recorded, and of these seven are known only from the Nooncanbah Series, and two only from the Wandagee Series. The distribution of the species is given in Table I, and a comparison of their measurements in Table II.

Discussion of the age and affinities of the bryozoan fauna of the Wandagee and Nooncanbah Series is left until a later paper.

#### DESCRIPTION OF SPECIES.

##### Phylum BRYOZOA Ehrenberg.

##### Class GYMNOLAEMATA Allman.

##### Order CRYPTOSTOMATA Vine.

##### Family FENESTRELLINIDAE Bassler.

##### Genus FENESTRELLINA\* d'Orbigny.

*Fenestrellina* d'Orbigny, 1849, *Revue et Magasin de Zoologie*, 2 e Ser., Tome I, p. 501.

Homonym:—*Fenestella* Lonsdale, 1839, preoccupied for a pelecypod, *Fenestella* Bolten, 1798.

\* An application for suspension of the Rules of Zoological Nomenclature for the generic name *Fenestella* Lonsdale, 1839, has been submitted to the International Commission on Zoological Nomenclature (G. E. Condra and M. K. Elias, *Journal of Paleontology*, Vol. 15, No. 4, pp. 565-566).

BRYOZOA FROM THE WANDAGEE AND NOONCANBAH SERIES  
(PERMIAN) OF WESTERN AUSTRALIA.

TABLE 1.—DISTRIBUTION OF SPECIES DESCRIBED.

	Wandagee Series.								Nooncanbah Series.					Other Localities.
	Calceolispongia Stage.					Linoproductus Stage.			9.	10.	11.	12.	13.	
	1.	2.	3.	4.	5.	6.	7.	8.						
<i>Fenestrellina horologia</i> (Bretnall)						+	+	+		+	+	+		Gascoyne River District: Callytharra Stage, Wooramel R.; Kampong Apna, Bituani, Noil Boewan (Bituani to Basleo Beds), Timor; Vancouver Island, and Springsure District, Queensland.
<i>Fenestrellina disjecta</i> sp. nov. ...						+						+	+	
<i>Fenestrellina ruidacarinata</i> sp. nov.											+			+B.
<i>Fenestrellina valentis</i> sp. nov. ...											—	+		
<i>Fenestrellina columnaris</i> sp. nov.	+	+	+											
<i>Fenestrellina lennardi</i> sp. nov. ...														+A.
<i>Fenestrellina cacuminatis</i> sp. nov.														
<i>Minilya duplaris</i> sp. nov. ...					+					+	+	+	—A.	Gascoyne River District: Wooramel River District: (?) Middle Productus Limestone, Salt Range, and Springsure District, Queensland.
<i>Minilya princeps</i> sp. nov. ...														
<i>Polypora forca</i> sp. nov. ...	+													
<i>Polypora retificis</i> sp. nov. ...		+												
<i>Polypora woodsi</i> (Etheridge) ...										+	+	+		Stony Ck, Branxton, Mulbring, Belford, Ulladulla (Branxton Stage, Upper Marine Series), N.S.W.; below Sonoma Rd. Crossing, Coral Ck, Bowen R., Queensland; Marlborough, Tasmania; Callytharra Stage, Wooramel R.; Bituani Beds, Timor, and Springsure District, Queensland.
<i>Polypora multiporifera</i> sp. nov. ...				+						+				
<i>Polypora</i> sp. nov. indet. ...									+					

1. Lower sandy part of the Calceolispongia Stage, South side of Minilya River, 1½ to 1¼ miles East-North-East from Curdamuda Well, Wandagee Station.
2. Lower half of the Calceolispongia Stage, ½ mile West of Coolkilya Pool.
3. Locality W.
4. Syncline on Minilya River, ½ mile West of Coolkilya Pool.
5. Uppermost part of the Calceolispongia Stage, North side of Minilya River, 1 mile West of Coolkilya Pool.
6. Lowest bed of Linoproductus Stage, East-West striking fault block, North-West of North end of Wandagee Hill, on Telephone Line, just inside Woollies Paddock, Wandagee Station.

7. 28 chains North-East of Flag Station 12, Nalbia Paddock, Wandagee Station.
8. Highest Pseudogastrioceras horizon, 300 yds. East of South-West gully of Wandagee Hill, Mungadan Paddock, Wandagee Station.
9. Scarp 2 miles East of Christmas Ck. Homestead.
10. 9 miles East-North-East of Trig. Station G2, St. George's Range, Kimberley District.
11. 6½ miles North of Mt. Anderson, Kimberley District.
12. Keevie's Well, 8 miles North of Mt. Anderson Homestead, Kimberley District.
13. Mt. Marmion, Kimberley District: A: Highest Beds of Nooncanbah Series, S. side of Mt. Marmion; B: Mt. Marmion (F17547, Australian Museum Coll.)



BRYOZOA FROM THE WANDAGEE AND NOONCANBAH SERIES  
(PERMIAN) OF WESTERN AUSTRALIA.

TABLE II.—MEASUREMENTS OF SPECIES DESCRIBED.

Species.	Locality.	Branches.		Fenestrules.		Width of Dissepiment (mm).	Zooecia.			Nodes.
		No. in 10 mm.	Width (mm).	No. in 10 mm.	Length (mm).		No. of Rows.	No. in 10 mm.	No. per Fenestrule.	
<i>Fenestrellina horologia</i> (Bretnall)	8 miles North of Mt. Anderson Homestead	20-22	0.29-0.38	16-18	0.29-0.52	0.1-0.29	2	37	2	High, in a single row, 0.23-0.31 mm. apart.
<i>Fenestrellina disjecta</i> sp. nov. ...	6½ miles North of Mt. Anderson	12	0.33-0.4	10	0.7-0.94	0.14-0.24	2	40	4-5	Very high, elongated, 0.98-1.17 mm. apart.
<i>Fenestrellina ruidacarinata</i> sp. nov.	9 miles East-North-East from Trig. Stn. G2, St. George's Ra.	16	0.33-0.38	10-10.5	0.6-0.75	0.21-0.27	2	38	3-4	Rounded, contiguous, 0.13-0.22 mm. apart.
<i>Fenestrellina valentis</i> sp. nov. ...	6½ miles North of Mt. Anderson	10	0.63-0.75	10	0.52-0.68	0.4-0.48	2	33	3-4	Small, rather rounded, 0.24-0.4 mm. apart.
<i>Fenestrellina columnaris</i> sp. nov.	½ mile West of Cookkilya Pool, Minilya River	16	0.33-0.38	14-15	0.44-0.5	0.22-0.3	2	37	3	High, thick, blunt, 0.33-0.4 mm. apart.
<i>Fenestrellina lennardi</i> sp. nov. ...	South side of Mt. Marmion	22	0.24-0.32	34	0.17-0.25	about 0.1	2	34	1	Small, not well shown.
<i>Fenestrellina cacuminatis</i> sp. nov.	8 miles North of Mt. Anderson Homestead	22	0.25	14	0.52-0.63	about 0.12	2	42	3	Small, sharp, 0.24-0.29 mm. apart.
<i>Minilya duplaris</i> sp. nov. ...	6½ miles North of Mt. Anderson	16-19	0.33-0.41	14-17	0.4-0.51	0.11-0.3	2	33	2	Small, in two rows, 0.13-0.17 mm. apart.
<i>Minilya princeps</i> sp. nov. ...	8 miles North of Mt. Anderson Homestead	17	0.41-0.48	10-10.5	0.57-0.62	0.32-0.36	2	28	3	Small, in two rows, 0.13-0.21 mm. apart.
<i>Polypora forcea</i> sp. nov. ...	8 miles North of Mt. Anderson Homestead	8-12	0.45-0.7	6-6.5	1.15-1.36	0.17-0.29	4-5	31	4-5	Small, irregularly developed.
<i>Polypora retificis</i> sp. nov. ...	½ mile West of Cookkilya Pool, Minilya River	15-17	0.48-0.57	9	0.67-0.8	0.41-0.6	3	33	4	Large, irregularly placed.
<i>Polypora woodsi</i> (Etheridge) ...	8 miles North of Mt. Anderson Homestead	10-11	0.52-0.62	8	0.68-0.92	0.46-0.63	3	31	4	Abundant, regularly placed, rather large.
<i>Polypora multiporifera</i> sp. nov. ...	½ mile West of Cookkilya Pool, Minilya River	5	0.97-1.1	1.5-2.5	2.1-5.6	0.46-0.6	5-6	22	6-14	Small, rather abundant.
<i>Polypora</i> sp. nov. indet. ...	Scarp 2 miles East of Christmas Ck. Homestead	3-4	1.2-1.55	1.5-2	3.3-6.9	1.2-1.6	about 8	?	9-15	? Not developed.



*Infundibuliform or flabellate Fenestrellinidae, with two rows of alternating zooecia on the branches, except before bifurcation, when the number of rows is increased; rows of zooecia separated by a medium carina, plain or more frequently with a single row of nodes (acanthopores); dissepiments not celluliferous; internal structure and reverse surface as for the family.*

**Fenestrellina horologia** (Bretnall).\* (Plate 1, figs. 3, 6.)

*Fenestrella horologia* Bretnall, 1926, descriptions of some Western Australian Fossil Polyzoa, *W.A. Geol. Surv. Bull.* 88, p. 15, pl. 1, fig. 6.

[non] *Fenestrella horologia* Bretnall, Hosking, 1931, Fossils from the Wooramel District, W.A., *Jour. Roy. Soc., W.A.*, Vol. XVII., p. 13, pl. IV., fig. 3.

*Fenestrella parviuscula* Bassler, 1929, Permian Bryozoa of Timor, *Paläontologie von Timor*, Lief. XVI., XXVIII., p. 76, pl. CCXLI (17), figs. 8-13.

*Fenestrella parviuscula* Bassler, Martin, 1932, De Paleontologie en Stratigraphie van Nederlandsch Oost-Indie, Bryozoa, p. 391.

*Fenestrella parviuscula* Bassler, Fritz, 1932, Permian Bryozoa from Vancouver Island, *Trans. Roy. Soc., Canada, Ser. 3*, Vol. 26, Sect. IV., p. 99.

*Fenestrellina parviuscula* (Bassler), Elias, 1937, Stratigraphic Significance of Some Late Paleozoic Fenestrate Bryozoans, *Jour. Paleontology*, Vol. 11, No. 4, p. 314.

*Fenestrellina with two zooecia to a fenestrule; carina low; nodes sharp, relatively high, about two to a fenestrule; fenestrules hour-glass shaped.*

Horizon and locality: Nooncanbah Series; Keevie's Well, eight miles north of Mt. Anderson Homestead, Kimberley District (Coll. A. Wade).

The form of the colony is not shown: there are from 16 to 18 fenestrules vertically, and from 20 to 22 branches horizontally, in 10 mm. The branches are straight, from 0.29 to 0.38 mm. in width, and show a slight, rather rounded carina, with sharp, relatively high nodes in a single row, at intervals of from 0.23 to 0.31 mm.; the bases of these nodes are slightly elongated parallel to the length of the branches. In the older parts of the colony supporting rootlets may be developed from the celluliferous surface, and the thickness of the branches (normally about 0.3 mm.) may be greatly increased by extra deposits of calcium carbonate; the nodes become very much thickened, and may appear bifid or trifid near the top, and the apertures become closed. The sides of the branches, on which the apertures are placed, are slightly flattened, but the apertures project into the fenestrules; they are circular, from 0.1 to 0.13 mm. in diameter, and where they are well preserved show about eight fine radially directed ribs; these, however, were very easily removed by weathering; the peristomes are distinct, and are best developed on the side towards the fenestrules. Two apertures occur in the length of one fenestrule and one dissepiment; these are usually very regularly arranged, one being placed opposite the end of each dissepiment, and one at the centre of each fenestrule—the projection of these apertures into the fenestrules gives them their characteristic hour-glass shape; a less regular arrangement may be developed for a few fenestrules. The distance between the centres of successive apertures is from 0.21 to 0.34 mm. (average 0.27 mm.), but is generally between 0.25 and

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\* This species is being revised, in a separate paper, from the type material in the collection of the Western Australian Geological Survey, with which the specimens here described have been compared.

0.3 mm.; about thirty-seven apertures occur in 10 mm. The fenestrules are from 0.29 to 0.52 mm. in length and from 0.17 to 0.4 mm. in width; the width of the dissepiments is from 0.1 to 0.29 mm., but is generally less than 0.2 mm., and the length of one fenestrule and one dissepiment is from 0.49 to 0.65 mm. (average 0.57 mm.). The dissepiments, where they are well-preserved, may show two or more fine transverse ridges, and the whole of the celluliferous surface is covered by very fine tubercles. On the reverse surface both branches and dissepiments are evenly rounded, and the dissepiments may be as thick as the branches; the outermost layer is finely granular, and the backs of the branches may be ornamented by fine nodes, though these are not always developed over the whole of the reverse surface, and are easily worn away. The inner layers of the reverse surface show fine longitudinal striae. Bifurcation occurs usually at distant intervals, though it may be frequent; increase to the three rows of zoecia occurs immediately before branching.

Remarks: *Fenestrellina horologia* was described by Bretnall from the Gascoyne River District; it occurs as low in the Permian-Carboniferous as the Callytharra Stage; and occurs also in Queensland (Consuelo Ck., two miles above Cattle Creek, Springsure District; Reid, 1930, p. 157, locality 9). It appears to be the same as *Fenestrellina parviuscula* (Bassler), which occurs in Timor in both the Bitaoeni and Basleo beds. *F. parviuscula* has also been recorded from the Permian of Vancouver Island.

#### ***Fenestrellina disjecta* sp. nov.**

Plate 1, Fig. 2; Text-figure 1 E.

Holotype: Specimen 2793a, University of Western Australia Collection. (Coll. H. W. B. Talbot.)

Horizon and locality: Nooneanbah Series; 6½ m. North of Mt. Anderson.

*Fenestrellina with four to five zoecia to a fenestrule: slight carina; very high nodes, one occurring in the length of each fenestrule, and usually placed opposite the junction of a branch and a dissepiment.*

The form of the colony is not shown; there are 12 branches horizontally, and 10 fenestrules vertically, in 10 mm. The branches are straight, from 0.33 to 0.4 mm. in width, and show a slight median carina, bounded by a depression on each side. Very high nodes, with their bases elongated parallel to the length of the branches, occur at intervals of from 0.98 to 1.17 mm., and are generally placed opposite the junction of a dissepiment with a branch; in well preserved specimens the height of these nodes is up to 0.25 mm., but they usually appear very much smaller. The apertures are circular, 0.08 mm. in diameter, and are surrounded by distinct peristomes. Four, less often five, apertures occur in the length of one fenestrule and one dissepiment; the distance between the centres of successive apertures is from 0.21 to 0.28 mm. (average 0.25 mm.) and about forty apertures occur in 10 mm. The fenestrules are oval, from 0.7 to 0.94 mm. in length, and from 0.29 to 0.54 mm. in width; the dissepiments are from 0.14 to 0.24 mm. in width, and the length of one fenestrule and one dissepiment is from 0.89 to 1.16 mm. On the celluliferous surface the dissepiments are slightly rounded and show four or five fine transverse ridges and grooves. On the reverse surface both branches and dissepiments show numerous fine longitudinal striations where they are slightly weathered. The dissepiments are distinctly thinner than the branches. At their junction with the dissepiments



the branches show fairly large, rather indistinct tubercles on the reverse surface. The lateral margins of each branch are angular. Bifurcation may occur at intervals of about 4 mm., but is usually much less frequent; increase to three rows of zooecia occurs immediately before branching.

Remarks: This species is distinguished from described species of similar size by its large, widely spaced nodes.

**Fenestrellina ruidacarinata** sp. nov.

Plate 2. Figs. 1, 2.

Holotype: Specimen 2757a, University of Western Australia Collection. (Coll. H. W. B. Talbot).

Horizon and locality: Nooncanbah Series; 9 m. E.N.E. from Trig. Stn. G2, St. George's Range.

*Fenestrellina with three to four zooecia to a fenestrule; carina low, nodes rounded, contiguous, five to six in the length of each fenestrule.*

The form of the colony is not shown; there are 16 branches horizontally, and 10 to 10.5 fenestrules vertically, in 10 mm. The branches are straight, and are rather rounded on the celluliferous surface; the apertures are placed on the sloping sides of the branches, but do not project into the fenestrules; the width of the branches is from 0.33 to 0.38 mm. The carina is almost obsolete, and is completely covered by the nodes, which are low, rounded, and contiguous, and which vary in diameter, though they do not vary in height, except as a result of weathering, which may remove all traces of the divisions between adjacent nodes and leave only a slight ridge along the centre of the branch. Five to six nodes occur in the length of each fenestrule; the distance between the centres of successive nodes is from 0.13 to 0.22 mm. The apertures are circular, 0.11 mm. in diameter, and are surrounded by distinct, but only slightly raised, peristomes; three apertures occur in the length of each fenestrule, and an extra one may occur opposite the dissepiment; the distance between the centres of successive apertures is from 0.24 to 0.3 mm., and about thirty-eight apertures occur in 10 mm. The fenestrules are oval, from 0.6 to 0.75 mm. in length, and from 0.24 to 0.35 mm. in width, and the dissepiments are from 0.21 to 0.27 mm. in width. On the celluliferous surface each dissepiment shows one or two strong transverse furrows. The reverse surface is not shown. Bifurcation occurs at intervals of more than 5 mm.; increase to three rows of zooecia occurs within one fenestrule before branching.

Remarks: The numerous low, contiguous nodes distinguish this form from any described Permian species. *Fenestrellina inaequalis* (Ulrich), from the Upper Coal Measures of Illinois, is similar in appearance; it is, however, a larger species, with rather more zooecia to a fenestrule, and shows smaller and much more numerous nodes.

**Fenestrellina valentis** sp. nov.

Plate 1. Fig. 4.

Holotype: Specimen 2793e, University of Western Australia Collection. (Coll. H. W. B. Talbot).

Horizon and locality: Nooncanbah Series; 6½ m. North of Mt. Anderson.

*Fenestrellina with three to four zooecia to a fenestrule; very broad branches; rounded carina with small nodes.*

There are 10 branches horizontally, and 10 fenestrules vertically, in 10 mm. The branches are very broad, from 0.63 to 0.75 mm. in width, and show a median, rounded, relatively low carina, with rather small, rounded nodes, placed from 0.24 to 0.4 mm. apart. The apertures are circular, 0.13 mm. in diameter, and are placed on the flattened sides of the branches; no peristomes are shown. From three to four apertures occur in the length of one fenestrule and one dissepiment; the distance between the centres of successive apertures is from 0.29 to 0.35 mm., and about 33 apertures occur in 10 mm. The fenestrules are oval, from 0.52 to 0.68 mm. in length, and from 0.36 to 0.44 mm. in width; the width of the dissepiments is from 0.4 to 0.48 mm. A cast of the reverse surface shows that both branches and dissepiments are evenly rounded, and that they are of the same thickness (about 0.4 mm.). On the celluliferous surface the dissepiments show numerous fine transverse striae when they are very slightly weathered.

Remarks: The broad, flattened branches and dissepiments distinguish this form from associated species.

***Fenestrellina columnaris* sp. nov.**

Plate 2, Fig. 3; Text-figure 1 F, G.

Holotype: Specimen 20949, University of Western Australia Collection. (Coll. C. Teichert and H. Coley.)

Horizon and locality: Lower half of the Calceolispongia Stage of the Wandagee Series; Syncline on Minilya R., ½ mile West of Coolkilya Pool.

*Fenestrellina with three zooecia to a fenestrule; carina slight, nodes large and very high.*

The colony was probably infundibuliform; the holotype is a large, very much folded expansion. There are 16 branches horizontally, and from 14 to 15 fenestrules vertically, in 10 mm. The branches are straight, from 0.33 to 0.38 mm. in width, and show a slight median carina, which bears a single row of high nodes, placed from 0.33 to 0.4 mm. apart. These nodes are slightly elongated along the carina at their bases, but above this they are rounded in cross section, and terminate bluntly; their height is up to 0.17 mm., and their diameter at the top may be as much as 0.2 mm., though it is generally less. The apertures are circular, 0.13 mm. in diameter, and are placed on the sloping sides of the branches, but do not project into the fenestrules; peristomes are not developed. Three apertures occur in the length of each fenestrule, and one of these may be placed opposite the end of a dissepiment; the distance between the centres of successive apertures is from 0.25 to 0.29 mm., and about thirty-seven apertures occur in 10 mm. Bifurcation of the branches may occur within 5 mm.; increase to three rows of zooecia occurs immediately before branching. The fenestrules are oval, from 0.44 to 0.5 mm. in length, and about 0.25 mm. in width; the width of the dissepiments is from 0.22 to 0.3 mm. On the reverse surface both branches and dissepiments are evenly rounded, although after slight weathering they appear angular; the dissepiments are as thick as the branches—about 0.75 mm.; the outermost layer of the reverse surface is finely granular. Rootlets, which are often forked, and are up to about 8 mm. in length, may be developed from the reverse surface.

Remarks: From *Fenestrellina horologia* (Bretnall) this species is distinguished by its larger size, by having more zooecia to a fenestrules, and by its large nodes. *Fenestrellina pulchradorsalis* (Bassler) is a larger species, and does not show large nodes.

***Fenestrellina lennardi* sp. nov.** (Text figure 1A.)

Holotype: Specimen 20948a, University of Western Australia Collection. (Coll. C. Teichert.)

Horizon and locality: Highest beds of the Nooncanbah Series; South side of Mt. Marmion, Kimberley District.

*Fenestrellina* with one aperture to a fenestrule; carina slight; nodes small.

The form of the colony is not shown; there are about 31 fenestrules vertically, and about 22 branches horizontally, in 10 mm. The branches are straight and flattened, and show a slight, rounded, rather wavy carina; small nodes are developed, but are not well shown. The branches are relatively very broad, being from 0.24 to 0.32 mm. in width; the zooecial apertures are circular, 0.1 mm. in diameter, and are surrounded by slight peristomes; they are usually very regularly placed, one occurring opposite the end of each dissepiment. The distance between the centres of successive apertures is from 0.29 to 0.38 mm., and about 31 occur in 10 mm. The fenestrules are oval, from 0.17 to 0.25 mm. in length, and generally about 0.21 mm. in width; the width of the dissepiments is about 0.1 mm. The reverse surface is not shown. Bifurcation occurs at relatively distant intervals, and increase to three rows of zooecia occurs just before branching.

Remarks: The small size of this species, and the arrangement of the zooecial apertures, separate it from associated species.

***Fenestrellina cacuminatis* sp. nov.** (Text figure 1B.)

Holotype: Specimen 20944a, University of Western Australia Collection. (Coll. A. Wade.)

Horizon and locality: Nooncanbah Series: Keevie's Well, 8 miles North of Mt. Anderson Homestead.

*Fenestrellina* with three zooecia to a fenestrule; carina slight; nodes small, sharp, evenly spaced.

The form of the colony is not shown; there are 14 fenestrules vertically, and 22 branches horizontally, in 10 mm. The branches are straight, about 0.25 mm. in width, and the carina is formed principally by the junction of the sloping sides of the branches; the nodes are small and sharp, but not high, and are placed from 0.24 to 0.29 mm. apart. The apertures are circular, 0.08 mm. in diameter, and are placed on the sloping sides of the branches; slight peristomes are developed, and where they are well-preserved the apertures project slightly into the fenestrules. The distance between the centres of successive apertures is from 0.22 to 0.27 mm., and about 42 occur in 10 mm.; there are three apertures to a fenestrule—one of these may be placed opposite the end of a dissepiment. The fenestrules are oval, from 0.52 to 0.63 mm. in length, and from 0.17 to 0.25 mm. in width; the dissepiments are about 0.12 mm. wide. On the obverse surface the dissepiments when slightly worn, show a few transverse grooves. The reverse surface is not shown.

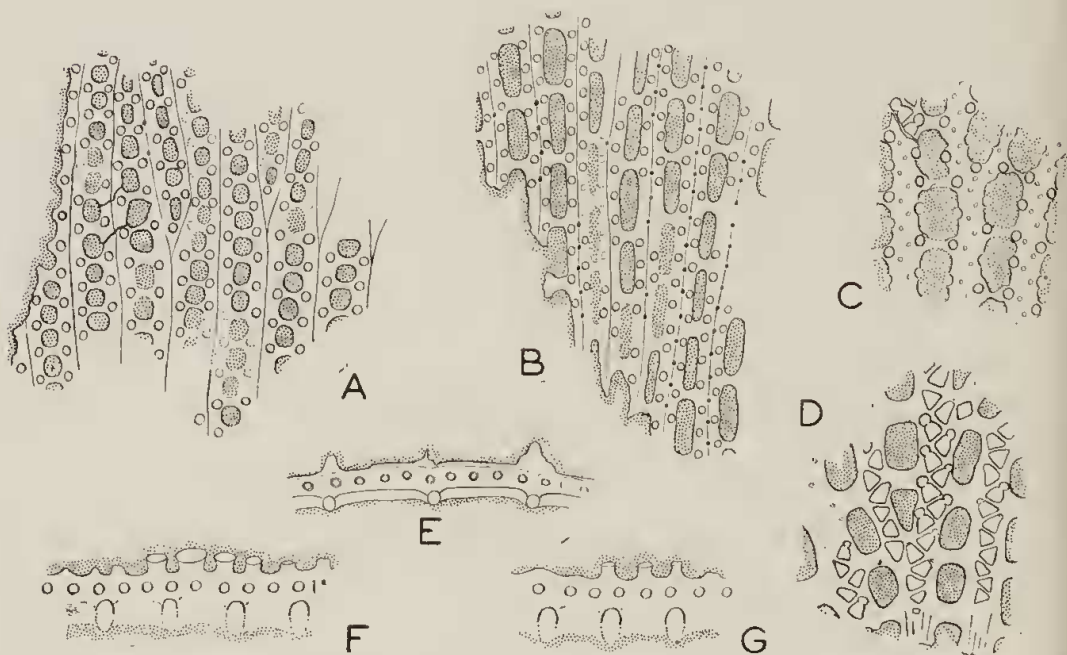
Remarks: This species is distinguished from *Fenestrellina pulchradorsalis* (Bassler) by its narrower branches and dissepiments, and smaller size. *F. affluensa* (Bretnall) is a larger species.

Genus **MINILYA** gen. nov.

*Fenestrellinae* in which the branches show two rows of alternating zooecia, one on each side of a slight median carina; nodes small, in two rows on the carina, placed so that one node is lateral to each zooecial aperture; zooecia sub-triangular; structure of the reverse surface as in *Fenestrellina*.

Range: Upper Pennsylvanian to Permian.

Genotype: *Minilya duplaris* sp. nov.



Text-Figure I.

A. *Fenestrellina lennardi* sp. nov.: Celluliferous surface of the holotype (No. 20948a, Univ. of Western Australia), x 10.

B. *Fenestrellina cacuminatis* sp. nov.: Celluliferous surface of the holotype (No. 20944a, Univ. of Western Australia), x 10.

C. *Minilya duplaris* sp. nov.: Portion of a thin section of a specimen from the Calceolispongia Stage of the Wandagee Series (Specimen in the University of Western Australia Collection), showing the double row of nodes and the arrangement of the zooecial apertures; the section has cut just above the level of the dissepiments, x 10.

D. *Minilya duplaris* sp. nov.: A thin section of the same specimen, showing the shape of the zooecia, and, on the left hand side, some of the tubercles characteristic of the reverse surface of this species, x 10.

E. *Fenestrellina disjecta* sp. nov.: Lateral view of part of one branch of a topotype (Specimen 2793b, University of Western Australia Collection), x 10.

F, G. *Fenestrellina columnaris* sp. nov.: Lateral views of two branches of the holotype, x 10.

(Camera lucida diagrams.)

Species belonging to this late Palaeozoic group have been described from the Upper Pennsylvanian of Texas and Kansas, and from the Permian of India, Timor, Kansas, Texas, Nebraska, and Eastern and Western Australia. A list of the measurements of some of the species

belonging here has been given by Elias (1937, p. 324). The following are amongst the species included in this group:—

- Fenestella geminanoda* Moore (Upper Pennsylvanian to Lower Permian).  
*Fenestella bispinulata* Moore (Upper Pennsylvanian).  
*Fenestella binodata* Condra (Upper Pennsylvanian).  
*Fenestella conradi* var. *compactilis* Condra (Upper Pennsylvanian to Lower Permian).  
*Fenestella kukaensis* Bassler (Permian).  
*Fenestrellina bituberculata* Crockford (Permian).  
*Fenestella perelegans* Meek, Waagen and Pichl (not *Fenestella perelegans* Meek), (Permian).  
\**Fenestella jabiensis* Waagen and Pichl (Permian).  
*Minilya duplaris* sp. nov. (Permian).  
*Minilya princeps* sp. nov. (Permian).

***Minilya duplaris* sp. nov.**

Plate I, figs. 5, 7; Text-figure 1 C, D.

*Fenestella horologia* Bretnall, Hosking, 1931, *Jour. Roy. Soc. W.A.*, Vol. XVII, p. 13, pl. IV, fig. 3.

[non] *Fenestella horologia* Bretnall, 1926, *W.A. Geol. Surv. Bull.* 88, p. 15, pl. I, fig. 6.

[ef.] *Fenestella perelegans* Meek, Waagen and Pichl, 1885, *Pal. Indica, Ser. XIII*, Vol. I, p. 777, pl. LXXXVII, figs. 1-3.

[non] *Fenestella perelegans* Meek, 1871, in Heyden's Final Report on Nebraska, p. 153, pl. VII, fig. 3.

Holotype: Specimen 2793d, University of Western Australia Collection. (Coll. H. W. B. Talbot).

Horizon and locality: Nooncanbah Series, 6½ miles North of Mt. Anderson.

*Minilya* with two zooecia to a fenestrule; carina slight; nodes sharp, relatively high, in two rows on the carina; reverse surface tuberculate.

The form of the colony is not shown: there are from 16 to 19 branches horizontally, and from 14 to 17 fenestrules vertically, in 10 mm. The branches are straight, from 0.33 to 0.41 mm. in width, and show a slight median carina, which may be produced upwards in a very thin, zig-zag ridge between the nodes, which are in two rows and are alternating; the nodes, where they are well preserved, are sharp and relatively high, and each node is placed lateral to an aperture; adjacent nodes are from 0.13 to 0.17 mm. apart. The apertures are circular, about 0.13 mm. in diameter; very thin peristomes are developed, but these are usually broken away. The apertures are placed on the steeply sloping sides of the branches, and project into the fenestrules; the distance between the centres of successive apertures is from 0.27 to 0.35 mm. (average 0.3 mm.), and about 33 occur in 10 mm. There are two apertures in the length of one fene-

\* In 1915 Frederiks (pp. 47-48) described a new sub-genus of *Fenestella*, *Fenestepora*, with three species, *Fenestepora jabiensis* (Waagen and Pichl), *Fenestepora foraminosa* (Eichwald), and *Fenestepora retiformis* (Schlotheim). The species considered by Frederiks to be identical with *Fenestella jabiensis* Waagen and Pichl is a different species; *Fenestepora* is considered to be a distinct genus, and *Fenestepora jabiensis* Frederiks [not Waagen and Pichl] has been chosen as genotype by Bassler (1935).

*Fenestepora* Frederiks is distinguished from *Fenestrellina* d'Orbigny by the presence of a row of small cellulose (as distinct from nodes) on the carina of each branch.

strule and one dissepiment, and these are generally regularly placed, with one opposite the end of each dissepiment, and one at the centre of each fenestrule, but one specimen shows slight irregularities in the placing of the apertures. The fenestrules are hourglass-shaped or oval, and are from 0.4 to 0.51 mm. in length and from 0.14 to 0.25 mm. in width; the dissepiments are from 0.11 to 0.3 mm. in width, and the length of one fenestrule and one dissepiment is from 0.51 to 0.73 mm. The reverse surface is not shown in specimens from the type locality, but specimens from the highest beds of the Nooncanbah series at Mt. Marnion, and from the Calceolispongia Stage of the Wandagee Series on the Minilya River show that the reverse surface of the branches is ornamented by very numerous, large, irregularly placed tubercles; the inner layers of the reverse surface show five or six fine longitudinal striae. The dissepiments are not quite so thick as the branches. Sections show that both superior and inferior hemisepta are developed; the shape of the zooecia is shown in Text-figure 1 D; they show a greater resemblance to those described by Nikiforova (1933, p. 13) for the *Fenestrellina donatica* group than to those of other forms. The tubercles of the reverse surface show in sections as rounded areas of lighter colour. Bifurcation generally occurs at infrequent intervals, but may occur within 3 mm.; increase to three rows of zooecia occurs immediately before branching.

Remarks: This species is probably the form described by Miss Hosking (1931) from the Wooramel River District as *Fenestella horologia* Bretnall, but it differs from *F. horologia* in having a double, instead of a single, row of nodes. It occurs in the Springsure District, Queensland (Consuelo Ck., two miles above Cattle Ck.; Reid, 1930, p. 157, locality 9). *Fenestella conradi* var. *compactilis* Condra, from the Upper Pennsylvanian and Lower Permian of Kansas and Nebraska, is differentiated by having less regularly arranged apertures and smaller nodes, which may not always be placed in two rows, as they are shown in Condra's figures; the measurements and figures given by Condra for this species do not always correspond. *Fenestella bispinulata* Moore, from the Upper Pennsylvanian of Kansas, is a smaller species, and differs in the appearance of the reverse surface. The species recorded as *Fenestella perelegans* Meek from the Middle Productus Limestone of the Salt Ranges by Waagen and Pichl is slightly finer than this species, as was noted by Miss Hosking, and possibly shows a rather higher carina; the reverse surfaces of the specimens examined by Waagen and Pichl were very much weathered; it is possible that these two species are identical. *Fenestrellina perelegans* (Meek), from the Coal Measures of Nebraska, possessed only a single row of nodes on the carina.

#### ***Minilya princeps* sp. nov.**

Plate 1. Fig. 1.

Holotype: Specimen 20945, University of Western Australia Collection. (Coll. A. Wade.)

Horizon and locality: Nooncanbah Series; Keevie's Well, 8 miles north of Mt. Anderson Homestead.

*Minilya* with three zooecia to a fenestrule; carina almost obsolete; nodes small, in two rows on the carina.

The form of the colony is not shown; there are from 10 to 10.5 fenestrules vertically, and 17 branches horizontally, in 10 mm. The branches

are straight, and are rounded on the celluliferous surface; they are from 0.41 to 0.48 mm. in width. The carina is broadly rounded and is poorly defined, and shows two rows of rather small nodes, which regularly alternate; each node is placed lateral to a zooecial aperture; the distance between adjacent nodes is from 0.13 to 0.21 mm. The apertures are circular, 0.13 mm. in diameter, and are placed on the sloping sides of the branches; they may project very slightly into the fenestrules; the peristomes are very poorly defined. There are usually two apertures in the length of each fenestrule, with an extra one opposite each dissepiment; the distance between the centres of successive apertures is about 0.35 mm., and twenty-eight apertures occur in 10 mm. The fenestrules are oval, from 0.57 to 0.62 mm. in length, and about 0.2 mm. in width; the width of the dissepiments is from 0.32 to 0.36 mm. On the celluliferous surface the dissepiments are rounded, and are covered by a thick, finely granular deposit; they are not depressed very much below the surface of the branches. On the reverse surface the branches and dissepiments are of the same thickness; both are evenly rounded; the outermost layer is finely granular. Bifurcation occurs at infrequent intervals, and increase to three rows of zooecia occurs immediately before branching.

Remarks: This species differs from *Fenestella jabiensis* Waagen and Piehl, from the Middle and Upper Productus Limestone of the Salt Ranges, in having fewer zooecia to a fenestrule, and a less well defined keel, and in having the dissepiments on the celluliferous surface nearly level with the branches; and from *Fenestella binodata* Condra in having fewer fenestrules in 10 mm., and much more widely spaced zooecia. *Minilya duplaris* sp. nov. is a finer form, and shows fewer zooecia to a fenestrule.

Genus **POLYPORA** McCoy.

*Polypora* McCoy, 1845, Synopsis of the Carboniferous Limestone  
Fossils of Ireland, p. 207.

Genotype: *Polypora dendroides* McCoy, 1845.

*Infundibuliform or flabellate Fenestrellinidae, with the zooecia arranged in three or more rows on the branches, except just after bifurcation, when only two rows may be present; nodes (acanthopores) usually present, but carina not usually developed; dissepiments not celluliferous; internal structure and reverse surface as in Fenestrellina.*

**Polypora fovea** sp. nov.

Plate 3. Figs. 1, 3.

Holotype: Specimen 20947, University of Western Australia Collection (Coll. A. Wade.)

Horizon and locality: Nooncanbah Series; Keevie's Well, 8 miles north of Mt. Anderson Homestead.

*Polypora with four to five rows of zooecia, and four to five zooecia to a fenestrule; nodes small, infrequently developed; branches and dissepiments narrow.*

There are 8 to 12 branches horizontally, and 6 to 6.5 fenestrules vertically, in 10 mm. The branches are straight and are relatively very narrow, being from about 0.45 mm. in width where there are four, to as much as 0.7 mm. where there are five, rows of zooecia; they usually show four to five rows of zooecia, with three—less often two—for one or two fenestrules after, and five to six just before, branching. The apertures are sub-circular,

0.11 by 0.06 mm. in diameter, and are surrounded by well-developed peristomes; they may be closed by a calcareous plate, frequently showing a small central perforation; the whole of the celluliferous surface shows strong ridges and grooves around and between the apertures. There are five, less often four, apertures to a fenestrule, the distance between the centres of successive apertures being from 0.25 to 0.35 mm.; about thirty-one apertures occur in 10 mm. Small nodes are irregularly developed. The fenestrules are sub-rectangular, from 1.15 to 1.36 mm. in length, and from 0.3 to 0.95 mm. in width; the dissepiments, which expand only slightly at their junction with the branches, are from 0.17 to 0.29 mm. in width. On the celluliferous surface the dissepiments are evenly rounded, and each shows four or five strong transverse ridges and grooves. On the reverse surface both branches and dissepiments are rather sharply rounded; the branches are rather thicker than the dissepiments, and show numerous fine longitudinal striae when they are very slightly worn; a row of fine tubercles may occur across the back of a branch at its junction with a dissepiment, but these are not always developed. The dissepiments show fine transverse ridges and grooves. Bifurcation of the branches occurs at intervals of 5 mm. or more.

Remarks: *Polypora virga* Laceron, which occurs in the Upper Marine Series in New South Wales, is a larger form, with usually three rows of zoecia.

#### ***Polypora retificis* sp. nov.**

Plate 2. Fig. 4.

Holotype: Specimen 20951, University of Western Australia Collection. (Coll. C. Teichert and H. Coley).

Horizon and locality: Calceolispongia Stage of the Wandagee Series: Syncline on Minilya River, half mile West of Cookilya Pool.

*Polypora with three rows of zoecia, and four zoecia to a fenestrule; nodes very large, but infrequently developed.*

The form of the colony is not shown; there are 9 fenestrules vertically, and 15 to 17 branches horizontally, in 10 mm. The branches are straight or slightly flexuous on the obverse surface, and normally show three rows of zoecial apertures, with four just before, and two for about two fenestrules after, branching; there is a slight carina where only two rows of apertures occur. Large nodes about 0.22 mm. in diameter are irregularly and infrequently developed, generally in the mid-line of the branch. There are four apertures in the length of one fenestrule and one dissepiment, either one or two of these being placed opposite the end of the dissepiment; the distance between the centres of successive apertures is from 0.24 to 0.38 mm., and about thirty-three apertures occur in 10 mm. The apertures are circular, about 0.11 mm. in diameter, and show thin peristomes; over a large part of the surface the apertures have been enlarged, and the peristomes removed, by weathering. The apertures may encroach on the ends of the dissepiments, but extra cells do not normally occur; in one place two branches each showing two rows of zoecia coalesce for a short distance after their separate bifurcations. The fenestrules are oval on the celluliferous surface, and are from 0.67 to 0.8 mm. long, and from 0.33 to 0.5 mm. wide; the width of the dissepiments is from 0.41 to 0.6 mm., and the length of one fenestrule and one dissepiment is from 1.16 to 1.38 mm. On the reverse surface both branches and dissepiments are rounded, and the fenestrules appear round or oval; the dissepiments are generally slightly



thinner than the branches; the outermost layer of the reverse surface is finely granular, but when it is weathered fine concentric striae are shown. On the celluliferous surface the branches are from 0.48 to 0.57 mm. in width where there are three, from 0.3 to 0.38 mm. where there are two, and about 0.85 mm. where there are four, rows of zooecia. Bifurcation may occur within 5 mm.

Remarks: *Polypora woodsi* (Etheridge) is differentiated by its far more numerous, and much smaller, nodes.

***Polypora woodsi* (Etheridge).**

Plate 3, fig. 2.

*Protoretetepora ampla* var. *woodsii* Etheridge, 1892, *Geology and Palaeontology of Queensland and New Guinea*, p. 222, pl. 8, fig. 12.

*Protoretetepora ampla* Lonsdale, de Koninck, 1878, *Mem. Soc. Roy. des Sciences de Liège, Ser. 2, Tome VII*, p. 42, t. 8, figs. 5 a - c.

[non] *Fenestella ampla* Lonsdale, 1844, in Darwin, *Geological Observations on Volcanic Islands*, p. 163.

*Polypora tumida* Laseyron, 1918, *Jour. Roy. Soc. N.S.W.*, Vol. LII, p. 191, pl. VII, fig. 3, pl. IX.

*Polypora tripliseriata* Bassler, 1929, *Palaeontologie von Timor*, Lief XVI, XXVIII, Permian Bryozoa of Timor, p. 79, pl. CCXLII (18), figs. 14-16.

*Polypora woodsi* Etheridge (Crockford), 1941, *Jour. Roy. Soc. N.S.W.*, p. 414, pl. XVIII, fig. 1, pl. XIX, fig. 1.

Specimens of this species occur in the material from three of the localities in the Kimberley District; the characters shown agree with those of the neotype.

Remarks: In New South Wales this species is abundant in the Fenestella Shales (Branxton Stage of the Upper Marine Series) in the Hunter River District, and in the Ulladulla Mudstones (probably about the same horizon in the Upper Marine Series) of the South Coast; it is not known from any other horizon in New South Wales. In Tasmania it occurs at Marlborough, and in the Grange Stage near Hobart; it has been recorded by Etheridge from Queensland, and occurs in the Springsure District (Consuelo Ck., two miles above Cattle Ck.; Reid, 1930, p. 157, locality 9). It occurs also in the Callytharra Stage of the Wooramel R. District. *Polypora tripliseriata* occurs in the Bitaoeni Beds at Kampong Apna in Timor.

***Polypora multiporifera* sp. nov.**

Plate 3, fig. 4.

Holotype: F. 38441, Australian Museum Collection (Coll. H. Coley).

Horizon and locality: Calceolispongia Stage of the Wandagee Series, Syncline on Minilya River, half mile West of Coolkilya Pool.

*Polypora* with five to six rows of zooecia, and from six to fourteen zooecia to a fenestrule; branches slightly convex; fenestrules long, irregular in length, and rather narrow; nodes small, fairly abundant.

There are from 1.5 to 2.5 fenestrules vertically, and about five branches horizontally, in 10 mm.: the branches are straight, and are rather rounded on the celluliferous surface, so that the lateral rows of apertures may open towards the fenestrules; they are from about 0.7 to 0.9 mm. wide where there are four, from 0.97 to 1.1 mm. where there are five, and about 1.1

mm. where there are six rows of zooecia; the width increases rather rapidly before branching, which occurs at relatively short intervals. Small nodes were apparently rather abundant, though they are now frequently weathered away; generally not more than two occur adjacent to each zooecial aperture. The whole of the celluliferous surface is finely tuberculate: the dissepiments show numerous fine transverse striae where they are slightly worn. There are usually five to six rows of zooecial apertures, with from six to seven before, and from three to four after, branching: the apertures are circular, about 0.16 mm. in diameter; no peristomes are shown: the distance between the centres of successive apertures is from 0.38 to 0.49 mm., and about twenty-two apertures occur in 10 mm. with from six to fourteen opposite each fenestrule. The fenestrules are from 2.1 to 5.6 mm. in length, and from 0.65 to 1.1 mm. in width; the dissepiments, which are not celluliferous, are from 0.46 to 0.6 mm. in width. The reverse surface is not shown. The cells are short and are rhomboidal in shape; they are from 0.32 to 0.38 mm. in length, and are about 0.24 mm. in width at their widest part; the extremities of successive cells in the same row are not in contact. No surface cells are developed.

Remarks: The rather numerous small nodes, the absence of any rounded surface cells, and the short, broad zooecia separate this species from *Polypora magnafenestrata* Crockford, from the Lower and Upper Marine Series of New South Wales.

*Polypora* sp. nov. indet.

Plate 2, fig. 5.

Horizon and locality: Nooncanbah Series; scarp two miles East of Christmas Ck. Homestead. (Specimen 20952 a, University of Western Australia Collection; Coll. A. Wade).

*Polypora* with about eight rows of zooecia, and with from nine to fifteen apertures to a fenestrule; nodes not developed.

The specimen is a rather weathered cast of the celluliferous surface, and the form of the colony is not well shown, though it was probably infundibuliform, with the celluliferous surface internal. There are from 3 to 4 branches horizontally, and from 1.5 to 2 fenestrules vertically, in 10 mm. The branches bifurcate at relatively very frequent intervals, generally less than the length of one fenestrule apart: they are usually from 1.2 to 1.55 mm. in width, but broaden considerably just before bifurcation. There are normally about seven or eight rows of zooecial apertures: the branches are thick and very convex, and the lateral rows of apertures open towards the fenestrules. The apertures are circular, about 0.14 mm. in diameter, and the distance between the centres of successive apertures is about 0.49 to 0.6 mm.; the number of zooecia in the length of one fenestrule and one dissepiment varies with the length of the fenestrules from about 9 to 15. No nodes are shown. The fenestrules are oval, from 3.3 to 6.9 mm. in length, and from 0.86 to 1.41 mm. in width at their widest part: the dissepiments, which expand considerably at their junction with the branches, are from 1.2 to 1.6 mm. in width; they are not celluliferous. The reverse surface is not shown.

Remarks: This species most closely resembles *Polypora gigantea* Waagen and Pichl, from the Middle Productus Limestone of the Salt Range, but is distinguished by its narrower fenestrules and broader dissepiments, and by its much more frequent bifurcations.

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 PLATE I.

- Figure 1. *Minilya princeps* sp. nov.: Part of the celluliferous surface of the holotype, showing the two rows of zooecial apertures, and the double row of weathered nodes along the centre of the branch (No. 20945, Univ. of Western Australia), x 10.
- Figure 2. *Fenestrellina disjecta* sp. nov.: Part of the celluliferous surface of the holotype (No. 2793a, Univ. of Western Australia), x 10.
- Figure 3. *Fenestrellina horologia* Bretnall: Part of the celluliferous surface of a specimen from the Nooneaubah Series at Keevie's Well, 8 miles north of Mt. Anderson Homestead (No. 20942, University of Western Australia), x 10.
- Figure 4. *Fenestrellina valentis* sp. nov.: Part of the celluliferous surface of the holotype (No. 2793c, Univ. of Western Australia), x 10.
- Figure 5. *Minilya duplaris* sp. nov.: Part of the celluliferous surface of the holotype (No. 2793d, Univ. of Western Australia), x 10.
- Figure 6. *Fenestrellina horologia* (Bretnall): Part of figure 3 enlarged to x 20, to show the single row of high nodes, and the apertures, which are stellate where they are best preserved.
- Figure 7. *Minilya duplaris* sp. nov.: Part of figure 5 enlarged to x 20, to show the arrangement of the apertures and the double row of nodes.

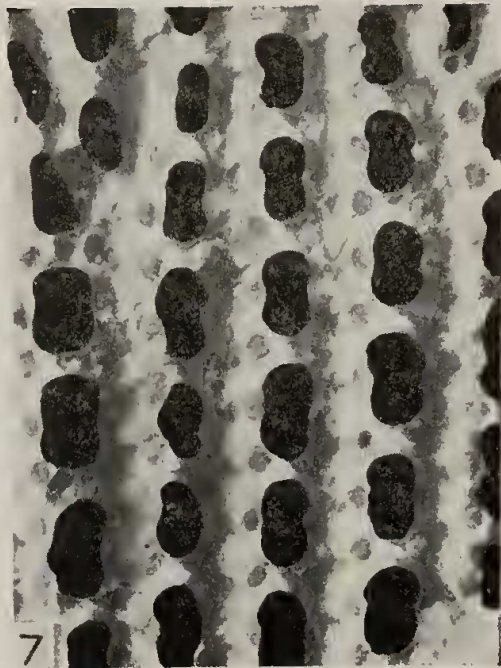
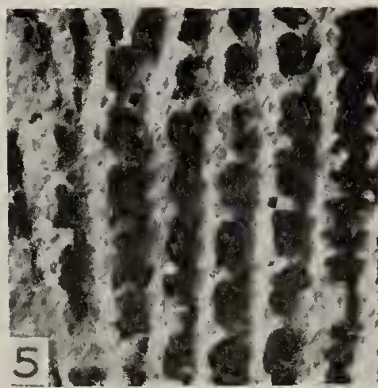
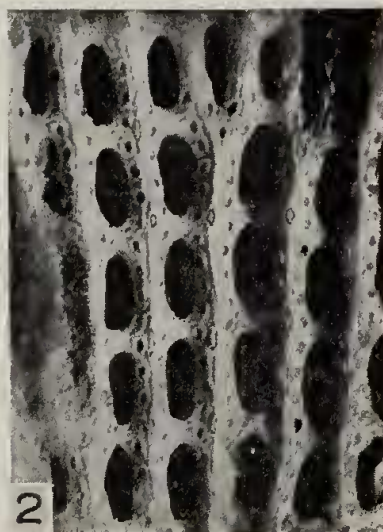
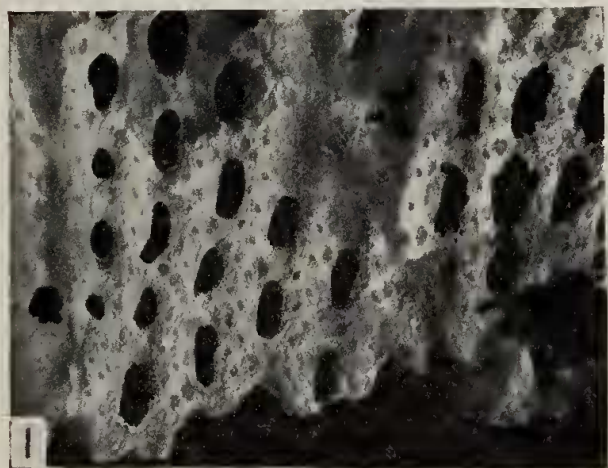


PLATE I.